CLAIMS

1) A method for determining a velocity model of seismic waves picked up by seismic receivers coupled with an underground formation, in response to the emission of seismic waves in the subsoil by a seismic source, after reflection on geologic interfaces of said formation, from multi-offset records of these waves, characterized in that it comprises at least the following stages for each seismic event located on the records and for each layer delimited by said interfaces :

a) from the prestack seismic records, constructing an iso-offset collection from which kinematic information or traveltimes associated with the event are extracted,

b) selecting a velocity range around a reference velocity in said layer, that is sampled with a predetermined interval,

c) for each velocity sample, applying an inversion technique at fixed velocity so as to determine, from the traveltimes extracted from the iso-offset collection, the geometry of said interface for the velocity sample concerned in order to obtain a series of interface/velocity pairs for said event,

d) calculating the kinematic information associated with each interface/velocity pair obtained, for source-receiver pairs corresponding to multi-offset collections existing in the seismic records,

e) for each interface/velocity pair and for each multi-offset collection selected, evaluating the coherence between the multi-offset traveltimes thus calculated and the seismic records, and selecting for each multi-offset collection the traveltime curve showing maximum coherence with the seismic records,

f) applying a prestack kinematic inversion method using the multi-offset traveltimes obtained for all the multi-offset collections selected, in order to determine the geometry and the velocity of the layer considered, and

g) iterating n times ($n \geq 0$) stages a) to f) by considering on each iteration the velocity model obtained during the previous iteration as the reference model to define said reference velocity.

2) A method as claimed in claim 1, characterized in that stage g) is carried out n times with $n \geq 1$ in cases where the velocity range selected is not sufficiently precise at the end of the previous iteration or of stages a) to f).

3) A method as claimed in any one of the previous claims, characterized in that, in cases where the velocities distribution varies greatly laterally and/or in cases where no sufficiently precise a priori knowledge of the velocity distribution in the layer considered is available, stage g) is carried out on offset ranges that are increasingly wider as iterations progress.

4) A method as claimed in any one of the previous claims, characterized in that, in cases where the velocities distribution varies greatly laterally and/or in cases where no sufficiently precise a priori knowledge of the velocity distribution in the layer considered is available, stage g) is carried out on multi-offset collection grids that are increasingly finer as iterations progress.

5) A method as claimed in any one of the previous claims, characterized in that, in stage e), in cases where the sought interface geometry generates triplications, the triplication branches in the multi-offset collections are considered independently of one another.

6) A method as claimed in claim 5, characterized in that stage e) is carried out using ray tracing and inversion tools allowing to take account of the multi-valuated arrivals.

7) A method as claimed in any one of the previous claims, characterized in that a zero-offset or a near-offset iso-offset collection is constructed in stage a).

8) A method as claimed in any one of the previous claims, characterized in that a fixed-velocity kinematic inversion technique such as a map migration is applied in stage c).

9) A method as claimed in any one of the previous claims, characterized in that the kinematic information is calculated in stage d) by tracing multi-offset rays on the interface of each interface-velocity pair.

10) A method as claimed in any one of the previous claims, characterized in that stage f) is carried out by applying a prestack kinematic inversion method such as a prestack traveltime tomography.